18th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Modeling and Risk Analysis (2)

Author: Dr. Haitao Zhang
Space Engineering University (Beijing), China, zhanghaitaoat@163.com

Prof. Zhi Li
Space Engineering University (Beijing), China, lizhipublic@163.com
Prof. Yasheng Zhang
Space Engineering University (Beijing), China, zhangyspublic@163.com
Mr. Huilong Shen
Space Engineering University (Beijing), China, 18101350187@163.com

RISK ANALYSIS FROM GEOSYNCHRONOUS SATELLITES' DEBRIS AFTER COLLISION

Abstract

A large number of spacecraft and space debris are densely distributed in the geostationary orbit (GEO) space, ranged about 200km from GEO in height. It is necessary to establish a risk analysis model, especially this model can be used to analyze the probability of new collision after a collision between space debris and a GEO satellite. Both British DAMAGE (Debris Analysis and Monitoring Architecture for the Geosynchronous Environment) model and NASA's LEGEND (LEO-to-GEO Environment Debris Model) model use 'Cube' collision probability calculation model. However, the 'Cube' model assumes that the space object's motion characteristics is the same as gas molecules in discrete volume unit. Therefore, a 'Grid' model is established specifically for geosynchronous environment, in which the motion of the space objects conforms to the orbital dynamics. Use the 'Grid' model to study the geosynchronous environment after space debris collides with a GEO satellite and both break up completely by analyzing the number of new collisions and space debris. A simulation shows that the number of new collisions and space debris will increase faster and faster. It is further concluded that if space debris collides with a GEO satellite and both break up completely, it will induce collision cascading syndrome in the GEO space.